Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

4033854116

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **October/November 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (AC/CGW) 98388/4

CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 It is given that $f(x) = 4x^3 - 4x^2 - 15x + 18$.

(i) Show that $x + 2$ is a factor of $f(x)$. [1]

(ii) Hence factorise $f(x)$ completely and solve the equation $f(x) = 0$. [4]

2 **(i)** Find, in the simplest form, the first 3 terms of the expansion of $(2-3x)^6$, in ascending powers of x. [3]

(ii) Find the coefficient of x^2 in the expansion of $(1+2x)(2-3x)^6$. [2]

3 Relative to an origin O, points A, B and C have position vectors $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$, $\begin{pmatrix} -10 \\ 12 \end{pmatrix}$ and $\begin{pmatrix} 6 \\ -18 \end{pmatrix}$ respectively. All distances are measured in kilometres. A man drives at a constant speed directly from A to B in 20 minutes.

(i) Calculate the speed in $\text{km}\,\text{h}^{-1}$ at which the man drives from A to B. [3]

He now drives directly from B to C at the same speed.

(ii) Find how long it takes him to drive from B to C. [3]

4 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 3 & 5 \\ 7 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 1 & -2 & 4 \\ -2 & 3 & 0 \end{pmatrix}$, calculate **2BA**. [3]

(b) The matrices **C** and **D** are given by $\mathbf{C} = \begin{pmatrix} 1 & 2 \\ -1 & 6 \end{pmatrix}$ and $\mathbf{D} = \begin{pmatrix} 3 & -2 \\ 1 & 4 \end{pmatrix}$.

(i) Find $\mathbf{C}^{-1}$. [2]

(ii) Hence find the matrix **X** such that **CX** + **D** = **I**, where **I** is the identity matrix. [3]

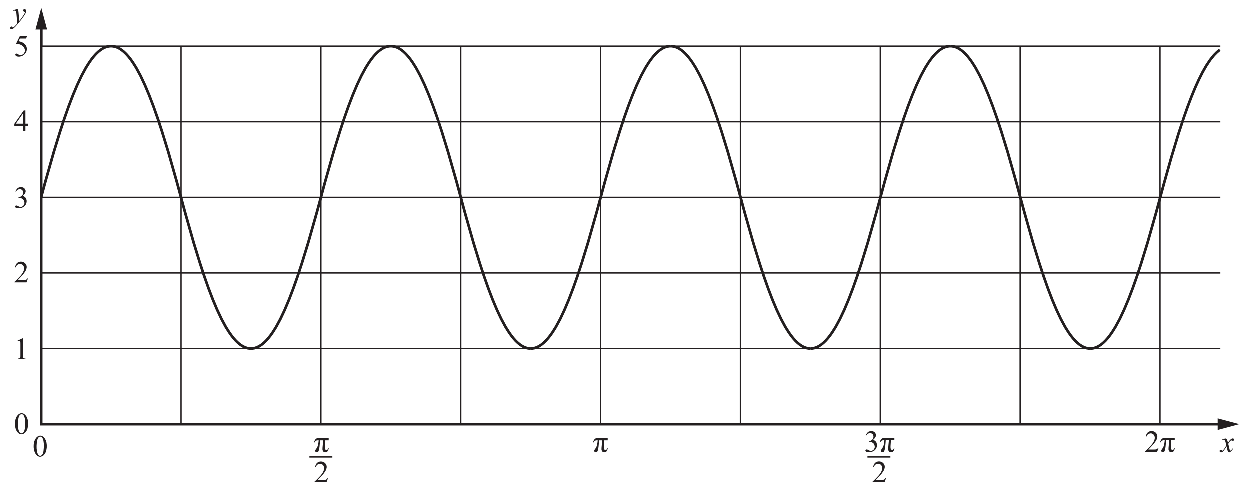
5 **(a)** Solve the following equations to find p and q.

$$8^{q-1} \times 2^{2p+1} = 4^7$$
$$9^{p-4} \times 3^q = 81$$

[4]

(b) Solve the equation $\lg(3x-2) + \lg(x+1) = 2 - \lg 2$. [5]

6



The figure shows part of the graph of $y = a + b\sin cx$.

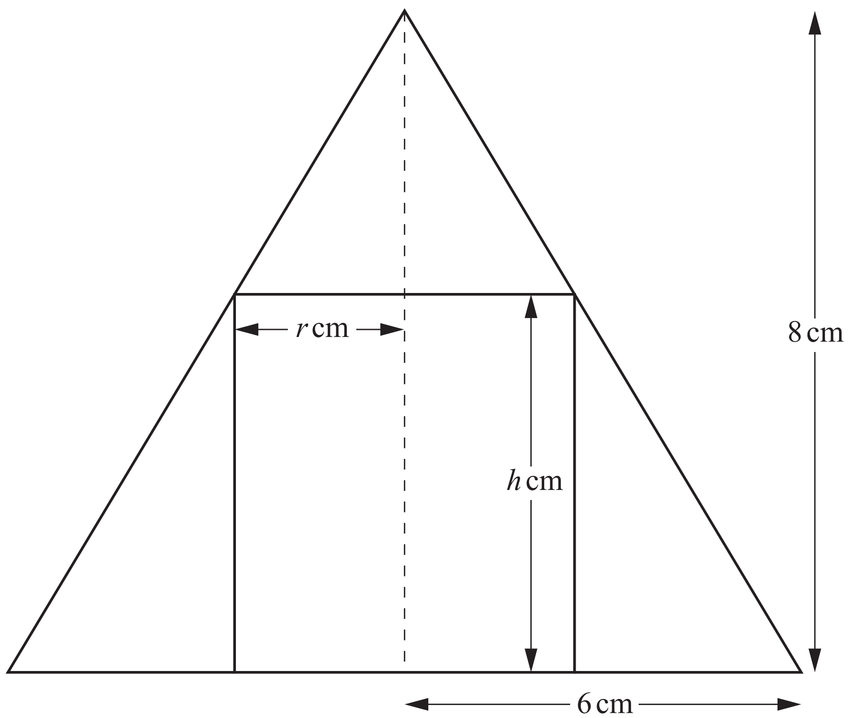
(i) Find the value of each of the integers a, b and c. [3]

Using your values of a, b and c find

(ii) $\dfrac{dy}{dx}$, [2]

(iii) the equation of the normal to the curve at $\left(\frac{\pi}{2}, 3\right)$. [3]

7



A cone, of height 8 cm and base radius 6 cm, is placed over a cylinder of radius r cm and height h cm and is in contact with the cylinder along the cylinder's upper rim. The arrangement is symmetrical and the diagram shows a vertical cross-section through the vertex of the cone.

(i) Use similar triangles to express h in terms of r. [2]

(ii) Hence show that the volume, V cm^3, of the cylinder is given by $V = 8\pi r^2 - \frac{4}{3}\pi r^3$. [1]

(iii) Given that r can vary, find the value of r which gives a stationary value of V. Find this stationary value of V in terms of π and determine its nature. [6]

8 **Solutions to this question by accurate drawing will not be accepted.**

Two points A and B have coordinates (–3, 2) and (9, 8) respectively.

(i) Find the coordinates of C, the point where the line AB cuts the y-axis. [3]

(ii) Find the coordinates of D, the mid-point of AB. [1]

(iii) Find the equation of the perpendicular bisector of *AB*. [2]

The perpendicular bisector of *AB* cuts the y-axis at the point *E*.

(iv) Find the coordinates of *E*. [1]

(v) Show that the area of triangle *ABE* is four times the area of triangle *ECD*. [3]

9 Solve the following equations.

(i) $4\sin 2x + 5\cos 2x = 0$ for $0° \leqslant x \leqslant 180°$ [3]

(ii) $\cot^2 y + 3\,\text{cosec}\, y = 3$ for $0° \leqslant y \leqslant 360°$ [5]

(iii) $\cos\left(z+\frac{\pi}{4}\right)=-\frac{1}{2}$ for $0 \leqslant z \leqslant 2\pi$ radians, giving each answer as a multiple of π [4]

Question 10 is printed on the next page.

10 A particle is moving in a straight line such that its velocity, $v\,\mathrm{ms}^{-1}$, t seconds after passing a fixed point O is $v = \mathrm{e}^{2t} - 6\mathrm{e}^{-2t} - 1$.

(i) Find an expression for the displacement, s m, from O of the particle after t seconds. [3]

(ii) Using the substitution $u = \mathrm{e}^{2t}$, or otherwise, find the time when the particle is at rest. [3]

(iii) Find the acceleration at this time. [2]